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ABSTRACT

The purpose of this study was to investigate the effects of three levels of learner control (no control, moderate control, and high control) on the achievement and continuing motivation of Hispanic students. Two weeks prior to the experimental part of the study, 101 seventh and eighth grade Hispanics were pre-assessed along an internal-external dimension. Subjects were stratified by sex and grade, then randomly assigned within classes to one of three versions of a computer-assisted instructional program on insects. In the no learner control version, subjects were assigned to the complete computer-assisted instruction (CAI) program consisting of informational screens plus all practice questions, feedback, and content reviews for missed items. Subjects in the moderate learner control version received the informational screens, practice items, and feedback, but had the option of bypassing each content review. The high learner control version gave students the option of bypassing each set of practice questions, as well as the content review, for each question they responded to but answered incorrectly. Continuing motivation data revealed a significant preference to study science when it was presented on the computer as compared to study of another subject in paper and pencil form. Analysis of en route data revealed that subjects under high learner control chose to receive practice 89 percent of the time, resulting in a small practice difference of 11 percent between program control and high learner control. Although females were found to have a much more internal locus of control than males, there was no evidence that Hispanic learners with an internal locus of control perform better than those with an external locus when given a relatively high degree of control in a CAI program. (32 references) (Author/GL)

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LOCUS OF CONTROL AND LEARNER CONTROL OF CAI

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Abstract

The purpose of this study was to investigate the effects of three levels of learner control (no, moderate, high) on the achievement and continuing motivation of Hispanic boys and girls.

Two weeks prior to the experimental part of the study, 101 seventh and eighth grade Hispanic subjects were pre-assessed along an internal-external dimension.

Subjects were stratified by sex and grade, then randomly assigned within classes to one of three versions of a CAI instructional program on insects. In the no learner control version, subjects were assigned to the complete CAI program consisting of informational screens plus all practice questions, feedback, and content reviews for missed items. Subjects in the moderate learner control version received the informational screens, practice items, and feedback, but had the option of bypassing each content review. The high learner control version gave students the option of bypassing each set of practice questions, as well as the content review, for each question they responded to but answered incorrectly.

Continuing motivation data revealed a significant preference to study science when it was presented on the

computer as compared to study of another subject in paper and pencil form. Analysis of en route data revealed that subjects under high learner control chose to receive practice 89 percent of the time, resulting in a small practice difference of eleven percent between program control and high learner control. Although females were found to have a much more internal locus of control than males, there was no evidence that Hispanic learners with an internal locus of control perform better than those with an external locus when given a relatively high degree of control in a CAI program.

Overall results indicate that CAI has a strong appeal for Hispanic students. Whether or not CAI is available to them significantly influences their motivation for additional instruction in the same subject-matter area.

LOCUS OF CONTROL AND CONTINUING MOTIVATION OF HISPANIC STUDENTS UNDER LEARNER-CONTROLLED CAI

The research to date on learner control in computer-assisted instruction (CAI) does not provide definitive answers to the questions of how much and what types of control learners should be given over instruction. In general, results suggest that allowing a moderate amount of learner control over instruction yields better achievement than permitting a higher degree of learner control for college students (Belland, Taylor, Canelos, Dwyer, Baker, 1985; Campanizzi, 1978) and junior high school students (Kinzie, Sullivan, & Berdel, 1988).

However, mixed results in achievement have been reported in research on learner control (Ross & Morrison, 1989). Differences in achievement favoring program control over learner control have been reported for urban seventh graders (Pollock & Sullivan, 1988) and undergraduates (Gay, 1986; Ross & Rakow, 1981). Goetzfried and Hannafin (1985) found no achievement differences for low ability seventh graders under three levels of learner control and concluded that learners with limited prior knowledge of subject content make less effective judgments regarding need for additional

instruction. However, Carrier and Williams (1988) found that suburban sixth graders in the learner-control treatment were superior in achievement on an instructional task to those in the program-control treatments, regardless of the amount of elaborative instruction received.

When research on learner control has included student attitudinal and motivational variables, more consistently favorable results have been reported. Kinzie and Sullivan (1989) found highly significant differences in continuing motivation for rural ninth- and tenth-grade science students, favoring learner control over program control.

A number of researchers have found that Hispanic students have a high internal locus of control (LOC) relative to Anglos (Buriel & Rivera, 1980; Garza & Ames, 1974; Powers & Wagner, 1983). Hispanics attribute academic success to their own personal efforts and failure to lack of ability or personal effort, rather than to external conditions (Hernandez, 1973; Willig, Harnisch, Hill, & Maehr, 1983). Whether learners with a stronger internal locus of control achieve better when they are given greater control over instruction has not been investigated with Hispanic students.

According to data from the National Assessment of Educational Progress (1977), there is a "tremendous disparity between achievement levels of the Hispanic and the Anglo student populations" (p. 31) in science achievement. Hispanic 13 year olds were 11.55 percentage points below the national average (58.5% versus 46.95%) in achievement scores on all cognitive items, 11.9 percentage points below the national average (58.0% versus 46.1%) in biology, and 9.9 percentage points below the national average (57.0% versus 47.1%) in physical science in the 1972-73 assessment. Similar results were reported four years later (NAEP, 1978). Clearly, a need exists to find ways to improve the science achievement of Hispanic students.

Besides achievement, student motivation is another important dependent measure. As defined by Maehr (1976), continuing motivation reflects a desire for future learning. Individuals display continuing motivation when they return to a learning activity at a later time without external pressure to do so. Pascarella, Walberg, Junker, and Haertel (1981) suggest that their findings are consistent with Maehr's (1976) hypothesis regarding the effect of control on student behavior. Using data from the NAEP, Pascarella et al. (1981) reported that

while teacher control was positively associated with science achievement for 13 and 17 year olds, the extent to which teachers, rather than students, controlled learning activities was negatively associated with continuing motivation.

Data on the continuing motivation of Hispanics toward science have not been encouraging. Hispanic 13 year olds were 11.8 percentage points (44.)%^ versus 32.2%) below the national average in reporting participation in science-related activities not required for science classes (NAEP, 1979).

Research on the effect of computers on continuing motivation suggest one potential advantage of the microcomputer. Kinzie and Sullivan (1989) found a strong positive effect of computers on continuing motivation. A majority (77%) of students in their study preferred to study science when it was available on computer as opposed to only 22 percent when it was not. Similar results for the positive motivational effect for computers have been reported by Seymour, Sullivan, Story, and Mosely (1987).

Another advantage of the microcomputer is that it permits control by individual learners over elements of instruction that heretofore were fixed parts of

instruction in print form. Elements in computer-assisted instruction (CAI) that can be controlled by the learner, rather than by the instructional program itself, include sequencing, amount of practice, type and immediacy of feedback, and review of content for practice items answered incorrectly.

The purpose of this study was to investigate the effects of three levels of learner control (no, moderate, high) on the achievement and continuing motivation of Hispanic students in grades 7-8. The perceived locus of control of subjects was pre-assessed along an internal-external dimension and its relationship to achievement was also analyzed.

Method

Subjects

Subjects were 101 Hispanic seventh and eighth grade students from six classes in an urban school with a primarily Hispanic enrollment located near Phoenix, Arizona.

Materials

The Intellectual Achievement Responsibility (IAR) scale (Crandall, Katkovsky, & Crandall, 1965), the most common measure of locus of control in research with school children (Stipek & Weisz, 1981) was used to

determine the perceived locus of control of subjects along an internal/external dimension. Consisting of 34 forced-choice items, the IAR assesses beliefs in internal-external responsibility for achievement in academic tasks and situations. Two separate subscales yield a composite score of responsibility for internal attributions for success (IAR+) and failure (IAR-). The sum of IAR+ and IAR- provides a total (IAR) index of internality. The test-retest reliability coefficient for the total IAR is .65 (Crandall et al., 1965).

The CAI program consisted of a series of informational screens on insects, 22 practice questions interspersed between the screens, feedback to the student's responses to each question, and a review of the information related to each question answered incorrectly.

Under no learner control, subjects were assigned to the complete CAI program consisting of the informational screens plus all practice questions, feedback, and content reviews for missed items. Under moderate control, subjects received the informational screens, practice items, and feedback, but had the option of bypassing each content review. Subjects under high learner control had the option of bypassing each set of

practice questions, as well as the content review for each question they responded to but answered incorrectly.

Procedures

The IAR measure was administered two weeks before the experimental treatments. Subjects were classified as internal or external on the basis of a median split on each of the three IAR scores, IAR_{total}, IAR+, and IAR- (McGhee & Crandall, 1968). Scores above the median on all three measures were classified as internal, while those below the median were designated as external.

Subjects were stratified by sex and grade and then randomly assigned within classes to one of three experimental treatments: no learner control, moderate learner control, or high learner control.

The three treatments were administered simultaneously by class in the school computer laboratory. Students were asked to sit at the computer which contained their name on its screen. After completing their assigned version of the lesson, students were administered the posttest followed by the continuing motivation questionnaire.

Criterion Measures

The primary criterion measure was the 25-item constructed-response posttest which covered the same

information as the instructional program. Posttest inter-item reliability calculated with Kuder-Richardson Formula 20 was .72.

The 4-item continuing motivation questionnaire assessed students' motivation to return to task and their preferred mode of presentation. This forced-response questionnaire assessed willingness to study insects on the computer or another subject on the computer, insects with paper and pencil or another subject with paper and pencil, insects on the computer or another subject with paper and pencil, and insects with paper and pencil or another subject on the computer.

Design and Data Analysis

The experimental design was a 3 (no learner control/moderate/high) x 2 (sex) x 2 LOC (internal/external) factorial design. Achievement data were analyzed by analysis of variance (ANOVA). The achievement difference by grade level was slight (.18) and nonsignificant, so data were collapsed across grade levels. Questionnaire responses were analyzed by chi-square.

Results

Table 1 shows that the overall posttest scores were 14.91 for no learner control, 15.54 for moderate, and

14.25 for high learner control. The mean posttest scores by sex were 15.57 for males and 14.00 for females. Neither the difference for type of control nor for sex was statistically significant.

Insert Table 1 about here

Mean overall achievement scores by locus of control, as shown in Table 1 were 14.58 for internal and 15.17 for external subjects, also a non-significant difference. Females (25.08) had significantly higher internal LOC scores than males (21.84), $F(1,95) = 18.25$, $p < .001$.

There were no significant relationships between locus of control and performance under the three learner control conditions. Internal LOC subjects scored 14.00 under no learner control, 16.62 under moderate control, and 13.41 under high learner control. External LOC subjects scored 15.38 under no learner control, 14.96 under moderate learner control, and 15.20 under high learner control.

Analysis of performance during instruction (en route performance) revealed that subjects under high learner control chose to receive practice on an average of 3.56 of the four practice sets, a surprisingly high 89% of the time, thus minimizing the treatment difference between

high learner control and no control. Internal LOC subjects did not choose more enroute practice than externals and did not perform better under high learner control.

Table 2 shows proportional responses to each of the four questionnaire items dealing with preference to return to instruction on insects or to receive instruction on another subject. Each option was offered either on the computer or in paper-and-pencil form.

There were no significant differences between treatments. However, between-item comparisons of questionnaire responses provide data on the effects of computers on student motivation.

Insert Table 2 about here

When given a choice of studying insects on the computer or another subject on the computer (item 1), only 36% of the subjects chose insect. When only the subject of insects was available on the computer and the other subject in paper-and-pencil form (item 3), 85% chose insects. This preference for instruction on the computer over paper-pencil instruction was significant, x^2 (1, N = 100) = 51.75, $p < .0001$.

Other comparisons yielded similar results favoring computer delivered instruction. The topic of insects was chosen by 46% of the subjects when both topics were available in paper-and-pencil form (item 2), but by only 21% when the topic was in paper-and-pencil form and another subject was on the computer (item 4), x^2 (1, N=100) = 13.75, $p < .001$. The topic of insects was chosen by 85% when it was available on the computer and the other subject in paper-and-pencil form (item 3), but by only 21% under the reverse condition (item 4), x^2 (1, N=100) = 81.45, $p < .0001$.

Discussion

The present study yielded no significant achievement effects between no control, moderate control, and high learner control. Examination of enroute performance of subjects yields a plausible explanation for the lack of a non-significant difference by treatment. Subjects under high learner control, who had the option to bypass all practice, selected 89% of the practice opportunities available to them, a surprisingly high percentage. Thus, subjects under high learner control actually practiced only 2.4 fewer items out of a total of 22 practice items, than did those under moderate control and no learner control. This small difference in practice can hardly be

expected to yield a difference in achievement. The results do not support the notion reported by Joe (1971) that individuals with an internal locus of control perform better when they are more in control of their environment. Internal LOC subjects actually selected slightly fewer practice opportunities (87%) than externals (92%). The fact that internals apparently did not try harder than externals under high learner control removes the primary reason for expecting that they might perform better than externals.

The data from this single study do not support the contention (Rotter, 1966; Crandall, et al., 1965) that an internal locus of control is a causal factor in promoting student achievement, at least with populations similar to the present one. Locus of control did not yield any significant relationships with achievement, nor did an internal locus result in greater student effort.

Program control did not yield greater achievement than relatively high learner control, the option to bypass practice in the instructional program. This variation has yielded a significant difference favoring program control in previous research with Anglos (Pollock & Sullivan, 1988; Novak, 1988; Fry, 1972). Nevertheless, the pattern within this study was similar to that across studies in

recent learner control research in that a smaller degree oflearner control yielded better achievement than a higher degree, though the difference was not statistically significant.

The preference data reveal that computer-delivered instruction has a strong appeal for Hispanic students. Subjects consistently reported a strong preference for computer-delivered instruction over instruction in paper-pencil form. Further, students chose to receive optional practice on the computer, when they could have bypassed it, 89% of the time. It may well be that the high practice rate was in part a function of the computer being the medium for delivery of the practice. Certainly, the strong computer preferences and high practice rate indicate a generally high level of motivation for students considered to be from an "at risk" population.

The reason for the lack of a significant difference herein may be the unusually high number of practice opportunities (89%) chosen by the Hispanic subjects in this study. This is consistent with research that has found learner control students to be good judges of the amount of instructional practice (Judd, Bunderson, Bessent, 1970) and the amount of elaborative instruction (Carrier & Williams, 1988) needed.

Monitoring en route decisions regarding the need for additional instruction (Tennyson, 1981) may prove to be a useful method for establishing the tendency of learners, especially Hispanic students, to engage in appropriate on-task behaviors regarding amount of practice or review needed. Merrill (1975) has suggested that learner control allows individuals to make instructional decisions and select optimal strategies which are suited for their unique aptitudes. Tennyson and Buttrey (1980) have concluded that learner control combined with meaningful advisement can be valuable to keep students on task long enough for them to obtain mastery. Recently, Ross and Morrison (1989) have suggested that learner-control strategies, based on individual preference and learning styles, offer the practical and motivational advantage of allowing individuals to control presentational aspects of instruction that affect their learning.

Further research is needed to explore the relationship of learner control over various aspects of instruction with the strong motivational appeal CAI has for students in general and Hispanics in particular. The potential exists to enhance the motivation of Hispanics to engage in science-related activities by adapting learner-control strategies to their individual cognitive and affective styles.

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Table 1

Posttest Mean and Standard Deviations by Treatment, Locus of Control, and Sex

	Learner Control			
Group	No	Moderate	High	Total
Internal				
Female				
M	13.50	16.00	13.50	14.27
SD	2.95	3.02	4.25	3.69
Male				
M	14.60	17.60	13.20	15.13
SD	2.30	5.59	3.42	4.17
Total				
M	14.00	16.62	13.41	14.58
SD	2.61	4.05	3.92	3.85
External				
Female				
M	12.00	13.67	16.33	13.53
SD	4.52	2.73	3.05	3.74
Male				
M	16.73	15.39	14.92	15.71
SD	3.94	3.58	4.78	4.02
Total				
M	15.38	14.96	15.20	15.17
SD	4.55	3.42	4.43	4.03
Grand Total				
M	14.91	15.54	14.25	14.93
SD	4.00	3.69	4.20	3.95

Table 2

Proportional Responses to Continuing Motivation Questionnaire

Questionnaire Item	Proportion choosing item
What would you prefer to study?	
1. Insects on the computer	.36
or	
another subject on the computer?	.64
2. Insects with paper and pencil	.46
or	
another subject with paper and pencil?	.54
3. Insects on the computer	.85
or	
another subject with paper and pencil?	.15
4. Insects with paper and pencil	.21
or	
another subject on the computer?	.78